REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application

Disposition of Claims

Claims 2-9, 11-23, 25-38, 40, 45, and 46 are pending in this application. Claims 45 and 46 are independent. The remaining claims depend, directly or indirectly, from claims 45 and 46.

Amendments to the Claims

New claims 49 and 50 are introduced by way of this response to positively recite that the simulation comprises a dynamic simulation. The Applicant submits that no new matter is added by way of these new claims.

Rejections under 35 U.S.C. § 103

Claims 2-7, 14-23, 25-38 and 45-48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over "The Operational Mechanics of The Rock Bit," by Ma, *et al.* (hereinafter "Ma"), in view of U.S. Patent No. 6,695,073, issued to Glass, *et al.* (hereinafter "Glass"), further in view of U.S. Patent Publication No. 2001/0020552 ("Beaton"), and further in view of U.S. Publication No. 2003/0051918 ("Chen").

Claims 8-9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ma in view of Glass, in further view of Chen, and in further view of "Drag-Bit Performance Modeling," SPE Drilling Engineering, June 1989 by Warren *et al.* ("Warren").

Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ma in view of Glass, further in view of Beaton, further in view of Chen, and further in view of U.S. Patent No. 6,039,131 ("Beaton2").

Ma relates to the kinematics of a roller cone bit. While Ma discloses various force determinations, Ma does not specifically disclose or suggest evaluating a bit structure on the basis of radial force, much less on the basis of a ratio of radial force to applied weight on bit.

Glass teaches a method for designing a bit that involves balancing forces and torques acting on cutters while a bit is drilling through a transitional section between soft and hard rock formations. Specifically, Glass discloses optimizing a fixed-cutter drill bit so that cutter forces and torques are evenly distributed not only during drilling of homogeneous rock, but also in transitional formations (Glass, Abstract).

Beaton discloses bi-center drill bits having certain arrangements of pilot blades and pilot sections and reaming blades and reaming sections (Beaton, Abstract). More specifically, Beaton relates to bi-center drill bits that are force balanced over the entire bit by calculating the forces exerted by each PDC cutter individually and selecting the locations of the blades and the PDC cutters thereon such that the sum of all the forces exerted by each of the cutters has a net imbalance of less than about 10 percent of the total axial force exerted on the bit (known in the art as the "weight on bit").

Chen is directed to the design of roller cone drill bits having optimized tooth orientation, such as the orientation of tooth angles. The tooth angle orientation is adjusted based on an expected trajectory of a tooth through formation.

Independent claim 45 requires, in part, a method for designing a drill bit, including: determining radial forces acting on a selected drill bit during simulated drilling; summing magnitudes of the radial forces with respect to a direction to generate a sum of the radial forces; comparing the sum of the radial forces to an applied weight on bit; generating a ratio between the sum of the radial forces and the applied weight on bit; adjusting at least one parameter of the selected drill bit based on the generated ratio *until the magnitude of the radial forces is less than a predetermined value for a preselected time for a simulated drilling*; and outputting a drill bit design based on the generated ratio and the adjusting.

Independent claim 46 requires, in part, a method for designing a bottomhole assembly, including: determining radial forces acting on a bottom hole assembly during simulated drilling, said bottomhole assembly including a drill bit; summing magnitudes of the radial forces with respect to a direction to generate a sum of the radial forces; comparing the sum of the radial forces to an applied weight on bit; generating a ratio between the sum of the radial forces and the applied weight on bit; adjusting at least one parameter of the bottom hole assembly based on the generated ratio *until the generated ratio is less than a predetermined value for a preselected time for a simulated drilling*; and outputting a bottom hole assembly design based on the generated ratio and the adjusting.

Initially, Applicant notes that both independent claims 45 and 46 require, in part, adjusting at least one parameter of the selected drill bit based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected time for a simulated drilling.

In the Office Action, the Examiner's position with respect to which reference purportedly teaches adjusting at least one parameter of the selected drill bit based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected time for a simulated drilling is not clear. For example, on page 6 of the Office Action, the Examiner asserts that Chen teaches defining variables in a simulation including revolutions and a preselected time. The Examiner continues indicating that the Applicant raises a valid point in that a revolution/quantum of time is not defined as a preselected time. The Examiner further indicates on page 10 that "a preselected time" is taught by Glass at Figure 3A.

While it is not clear whether the Examiner maintains that Glass teaches the referenced limitation, for completeness, the Applicant submits that neither Glass nor Chen teach adjusting at least one parameter of the selected drill bit based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected time for a simulated drilling.

Turning first to Glass, Figure 3A shows measurements resulting from a simulation (Glass, col. 5, lines 24-25). Applicant notes that simulations necessarily must occur as time passes. Glass explains that Figure 3A shows a plot of various measured torques for typical PDC bit designs as the bit drills through rock varying in hardness, and inserts showing corresponding cutter damage

(Glass, col. 5, lines 24-31). In particular, Glass discloses using an Amoco model (also referred to as "Amoco program") to simulate down-hole conditions while simulating drilling through a transition zone of differing compressive strengths and the data from the Amoco model is then plotted graphically to represent the percent torque per cutter distribution under a specified drilling condition. This is exemplified by Figure 3A and its associated text. Thus, Glass is directed to using outputs from the Amoco program to generate torque per cutter distribution graphs, and using those graphs to reduce local maximums in torque on cutter for transitional regions.

Applicant respectfully asserts that it is not possible for Glass, and the use of the Amoco model, to teach or suggest the use of time as a variable, as required in part by the present claims, and this is exemplified in several ways. For example, the modeling method described by the Amoco model only outputs a single numeric answer, such as the volume of rock removed by a cutter, the total weight-on-bit, bit torque, etc. Thus, the Amoco model does not provide a dynamic model or simulation of drilling. This is further demonstrated by the fact that the Amoco model does not provide any use of time as a variable, or any suggestion of using time as a variable. Thus, the Amoco model is limited to providing a static model. Therefore, Glass and the Amoco model, do not teach or suggest the use of time as a variable, or the selection of a pre-selected amount of time.

The Examiner only addresses this argument by indicating that the Declaration of Azar provided in the Submission Accompanying a Request for Continued Examination was not persuasive. Particularly, the Examiner indicates that the Declarant has a vested interest in the outcome. However, the Examiner has provided no rationale articulating the interest of the Declarant. The Declarant is not an inventor to the present invention, and not presumption of a

vested interest in the invention is allocated to the Declarant merely because the Declarant is an employee of the Assignee of the Invention. If the Examiner is aware of any basis in law that supports such a presumption, the Applicant respectfully requests the Examiner provide such basis in law. An affidavit of an applicant as to the advantages of his or her claimed invention, while less persuasive than that of a disinterested person, cannot be disregarded for this reason alone. *Ex parte Keyes*, 214 USPQ 579 (Bd. App. 1982); *In re McKenna*, 203 F.2d 717, 97 USPQ 348 (CCPA 1953); MPEP 716.01(c).

The Declaration of Azar sets forth that Glass is not directed to simulation within the meaning of the present invention because the "simulation of drilling" is limited to a single numeric answer, such as the volume of rock removed by a cutter, the total weight-on-bit, bit torque, etc. While the Examiner asserts that the features of simulation are not recited in the rejected claims, the Applicant respectfully submits that the limitation of "adjusting at least one parameter of the selected drill bit based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected amount of time for a simulated drilling" is recited verbatim in claims 45 and 46. Furthermore, the Applicant hereby adds new claims 45 and 46 specifically reciting that the simulation in dynamic.

In addition, Applicant notes that Figure 3A in Glass (a torque distribution graph) only provides a measurement of torque based on revolutions of a drill bit. In other words, such a torque distribution graph is only concerned with ft-lbs of torque that are applied to a cutting element at a certain point of revolution of the drill bit within a formation. Applicant further notes that time is relative when taking measurements based on the revolution of a drill bit because the amount of

time per revolution necessarily depends on the speed of revolution. Thus, it is not possible for time to be measured or pre-selected based on the data provided in Figure 3A and its associated text.

Turning to the Examiner's assertion that "Glass teaches the limitation of preselected time" because "Applicant admits... that time passes during [the] boxed simulation cycle [of Glass]" (*see* Office Action, pages 2 and 3), assuming the Examiner maintains this position, Applicant respectfully disagrees. To Applicant's knowledge, there is presently no known method of stopping time. In other words, time is always progressing. Thus, Applicant acknowledges, as asserted by the Examiner, that during any type of simulation, time does indeed pass. However, Applicant maintains that the fact that time does not stop does not teach or suggest selecting a preselected amount of time. Selecting a preselected time necessarily requires performing an action (*e.g.*, preselecting an amount of time) prior to a step that will use the action (*e.g.*, measuring variables during the preselected amount of time). Applicant does not see how preselecting an amount of time could be taught or suggested by the well-known fact that time does not stop, as asserted by the Examiner. Thus, contrary to the Examiner's assertion, there is no teaching or suggestion that the particular timeframe shown in Figure 3A is comparable to a preselected time.

With respect to Chen, the Examiner asserts Chen teaches "preselected time used for a simulation. (Office Action, page 6). Initially, the Examiner is breaking the limitation of "adjusting at least one parameter of the selected drill bit based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected amount of time for a simulated drilling" into a single element, namely, only a "respected amount of time." Chen clearly does not teach the limitation in total, specifically, "adjusting at least one parameter of the selected drill bit

based on the generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected amount of time for a simulated drilling." Accordingly, the combination of references still does not teach each and every element and limitation, as required to support a proper rejection under Section 103. Section 2143.03 of the M.P.E.P. requires consideration of every claim feature in an obviousness determination. The asserted combination of references must teach or suggest each and every claim feature. *See In re Royka*, 490 F.2d 981 (CCPA 1974); *In re Saether*, 492 F.2d 849, 852 (CCPA 1974). The Board of Patent Appeal and Interferences has recently confirmed that a proper obviousness determination requires that an Examiner make "a searching comparison of the claimed invention – including all its limitations – with the teaching of the prior art." *See In re Wada and Murphy*, Appeal 2007-3733 (BPAI 2008) (*citing In re Ochiai*, 71 F.3d 1565, 1572 (Fed. Cir. 1995)). This line of reasoning was further expanded upon by the Board of Patent Appeals and Interferences noting that when a reference is silent to an element, "it becomes incumbent upon the Examiner to provide a basis in fact...that would support a finding [of the claim element being present]." *Ex Parte Sternby*, Appeal 2009-007462 (June 8, 2010) (non-precedential).

Moreover, Chen does not actually teach the adjustment of a parameter until a resultant value is less than a predetermined value for a preselected amount of time. The reference to "time" in Chen is in reference to an input for a simulation time. A simulation time refers to running a simulation for a predetermined time, not running a simulation until a value is less than a resultant value for a preselected time. Applicant also notes that the invention as a whole must be considered in an obviousness determination. The "invention as a whole embraces the structure, its properties, and the problem is solves." *In re Wright*, 848 F.2d 1216 (Fed. Cir. 1988). All limitations, including

the specifically claimed properties recited in the claims of the present application, must be considered in an obviousness determination. In making an obviousness determination, the PTO is "obligated to consider all the evidence of the properties of the claimed invention as a whole, compared with those of the prior art." *In re Dillon*, 919, F.2d 688 (Fed. Cir. 1990). The Examiner's analysis is not taking into consideration the structure, properties and the problem that is solved, rather, the Examiner's analysis merely looks for words within a reference that are the same as the words in the claims. The Examiner is effectively reading out the meaning of the claims limitation in his analysis.

Furthermore the Applicant respectfully notes that, "focusing on the obviousness of substitutions and differences, instead of on the invention as a whole, is a legally improper way to simplify the often difficult determination of obviousness." *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720 (Fed. Cir. 1990). In accordance with Federal Circuit precedence, in forming a proper rejection under 35 U.S.C. § 103(a), the Examiner must consider the invention as a whole, *i.e.*, the entire disclosure of Glass and/or Chen, while not merely focusing on whether it would be obvious to select a time from a timeline. As the Examiner in this case has simply asserted that the presence of time in Glass' simulations is analogous to having a "preselected time," or alternatively using time as a value in a simulation teaches the use of time in optimizing a parameter of the present application, the Examiner has improperly focused on a substitution, rather than on the invention as a whole. The specification of Glass provides no support for a reading of Figure 3A to the contrary of the reading submitted by the Applicant. Similarly, there is no support in the specification or figures of Chen to support the teaching of "adjusting at least one parameter of the selected drill bit based on the

generated ratio until the magnitude of the radial forces is less than a predetermined value for a preselected amount of time for a simulated drilling."

Because neither Ma nor Beaton teach that which Glass and Chen lacks, the combination does not establish a prima facie case of obvious with respect to claims 45 and 46. Accordingly, claims 45, 46, and all claims depending either directly or indirectly therefrom are patentable over the proposed combination of references.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 05516/148002).

Dated: January 5, 2011

Respectfully submitted,

By_____

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